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Joining connection and a method for producing the same,
and steering column of motor vehicles

5 The invention relates to a joining connection according to the precharacterizing clause of Patent Claim 1 and to a method for producing the same according to the precharacterizing clause of Patent Claim 6, and to a steering column of motor vehicles according to the precharacterizing clause of Patent Claim 11.

10 A steering column of the generic type is disclosed in DE 36 00 134 C1 whose casing tube, which consists of plastic, has injection moulded integrally on it a holder for the securing of a steering column switch. The outlay on the engineering of the mould is very considerable in
15 this case, since the injection mould has to be of very complex design. Furthermore, because of the stiffness required by the casing tube, the plastic of the casing tube is very brittle and is therefore easily breakable in the event of a crash, which may mean serious consequences
20 in terms of health for the vehicle occupants, in particular for the driver.

In various applications, components which are exactly aligned with one another have to be secured on a hollow profile or a tube, the securing between the component and
25 tube, i.e. the joining connection, having to withstand axial displacement forces and torsional moments. One possible joining technique is the internal high-pressure deformation technique which is used in the production of frictional connections between the component and tube,

for example in the case of engineered camshafts. In this case, first of all the components to be joined, namely the cam and tube, are positioned with respect to each other and then the tube is partially acted upon by means of internal high pressure - delivered via an expansion lance inserted into the tube - below the cam. This results successively in flowing of the tube material, in expansion and bearing of the tube material against the cam and in the common expansion of the tube material and cam material. The pressure is set in such a manner that the cam can spring back elastically after it has been relieved of pressure. The springing-back together with a simultaneous, permanent increase in diameter of the tube enables a virtually nonreleasable, frictional joining connection to be achieved. However, a precondition for this type of joining connection is that the yield strength of the joining part, the cam, is greater than the yield strength of the tube. However, if the yield-strength ratios are reversed, the internal high pressure, which acts in an expansive manner, causes the joining part to explode relatively rapidly.

A joining connection of the generic type and a method for production thereof is also disclosed in DE-A-2 400 148, in which a tube is slid through a hole in a tube plate and, after insertion into the tube of a probe provided with axially spaced sealing rings, is subjected to a pressurized liquid via a duct of the probe which first of all runs axially and then radially between the sealing rings. The tube is thereby expanded and becomes positioned against the hole wall of the tube plate, in which case only the surrounding region of a weld, which has been undertaken on the end side between the tube and

tube plate, remains recessed. In order to obtain higher withdrawal forces, widened portions lying one behind another in the hole wall are incorporated, with the result that during the hydraulic expansion of the tube a form-fitting connection also comes about together with - as seen in the axial direction - undercuts which result in the tube becoming jammed in the hole of the tube plate. In this case, it is disadvantageous that the tube material is first of all positioned against the hole wall and only then is pressed into the widened portions, since the premature bearing enables friction to occur between the tube and the hole wall, the friction obstructing further flow of material into the widened portions. In this connection, depending on the depth of the widened portions, the material can become thinned at this point to such an extent that the tube may burst and the production reliability is thus not ensured as desired. Furthermore, the use of material for the tube plate is restricted, since, when a material having a lower yield strength than the material of the tube is used, after bearing of the tube against the hole wall the tube plate would inevitably break during further expansion into the widened portions.

The invention is based on the object of finding a joining connection and a method for the production thereof, with which a hollow profile and an add-on part having a lower yield strength than the hollow profile can be connected nonreleasably to each other in a simple, reproducible and reliable manner. Furthermore, a steering column of the generic type is to be developed in such a manner that a holder can be reliably fitted as an add-on part to the casing tube of the steering column, said holder having a

lower yield strength than the casing tube, with a low outlay on components and costs and with an exactly reproducible positioning of the two joining partners with respect to each other in the joining connection.

- 5 The object is achieved according to the invention by the features of Patent Claim 1 with regard to the joining connection, by the features of Patent Claim 6 with regard to the method for production thereof, and by the features of Patent Claim 11 with respect to the steering column.
- 10 By means of the invention, because of the local expansion of the hollow profile into the recess and because of the bearing of the hollow profile under prestress as a consequence of the more extensive expansion, the add-on part obtains, at least at some points or in subregions of
- 15 the recess walls of the add-on part, axial fixing and at the same time a rotationally fixed connection on the
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